National Aeronautics and Space Administration

NASAfacts

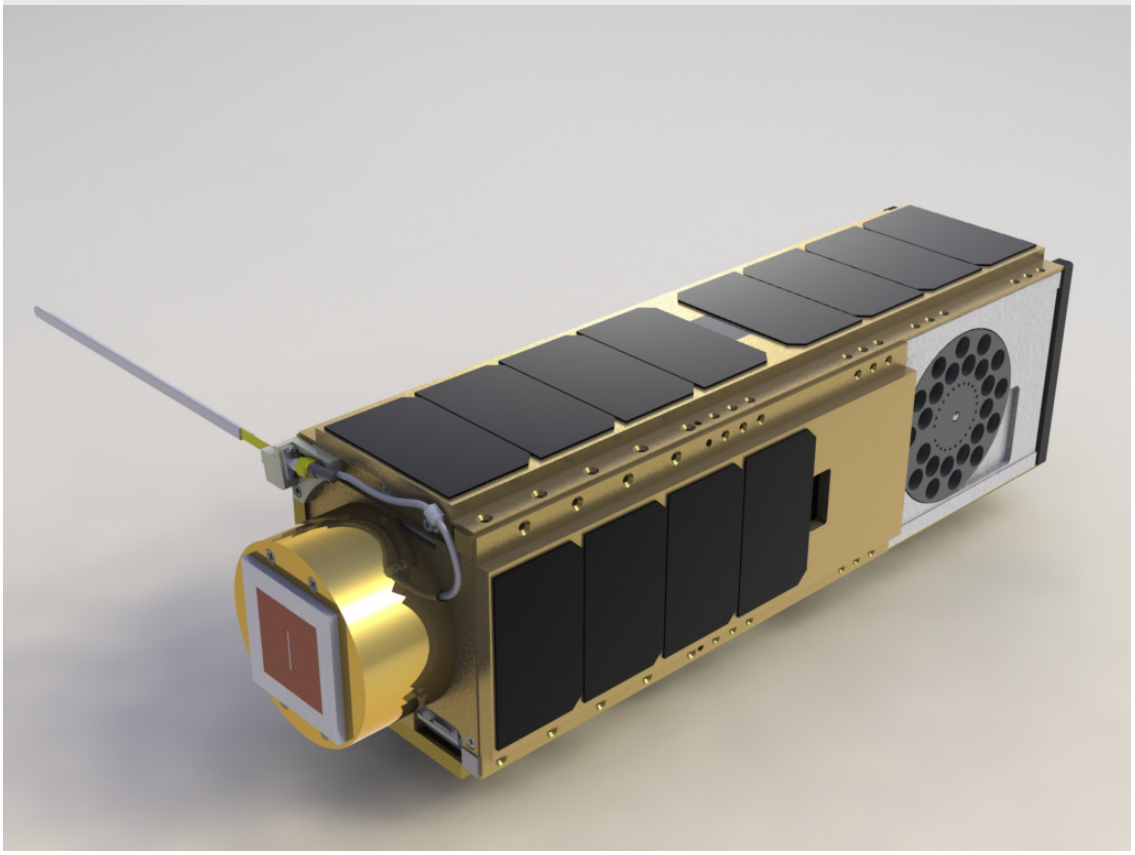
Organism/Organic Exposure to Orbital Stresses (O/OREOS) Nanosatellite

An Astrobiology Technology Demonstration

NASA's Organism/Organic Exposure to Orbital Stresses, or O/OREOS, nanosatellite is about the size of a loaf of bread, weighs approximately 12 pounds and has two experiments that will activate once it reaches low Earth orbit, more than 400 miles above Earth. The O/OREOS nanosatellite is a secondary payload on a multi-spacecraft mission that will launch into orbit on a United States Air Force Minotaur IV rocket from the Alaska Aerospace Corporation's Kodiak Launch Complex on Kodiak Island, Alaska. The mission is named STP-S26, after the twenty-sixth small launch vehicle mission of the Department of Defense Space Test Program managed by the Space Development and Test Wing, a unit of the Air Force Space and Missile Systems Center, that is operated out of Kirtland Air Force Base, N.M.

Mission Overview

The O/OREOS spacecraft is a science demonstration that showcases NASA's achievements in using hardware from a technology development program led by the Small Spacecraft Division at NASA's Ames Research Center, Moffett Field, Calif. NASA designed and developed the next-generation,



A computer-generated image of the O/OREOS nanosatellite. Image credit: NASA/Eric Stackpole

miniaturized triple-cube satellite system that O/OREOS employs. The nanosatellite platform opens secondary payload opportunities, or "piggy-back rides," to conduct research in space at lower cost and with greater frequency than previously possible. The O/OREOS spacecraft is NASA's first cubesat to demonstrate the capability to have two distinct, completely independent science experiments on an autonomous satellite. One payload will demonstrate the ability to test how microorganisms survive and adapt to the stresses of space; the other will monitor the stability of organic molecules in space.

The overall goal of the O/OREOS mission is to demonstrate capability to conduct low-cost science experiments on autonomous nanosatellites in space in support of the Astrobiology Small Payloads program under the Planetary Science Division of the Science Mission Directorate at NASA's Headquarters. The Small Spacecraft Division at Ames manages the O/OREOS payload and will provide mission operations from the mission control center at Ames with the professional support of staff and students from Santa Clara University, Santa Clara, Calif. Scientists will apply the knowledge they gain from O/OREOS to plan future experiments in the space environment to study how exposure to space changes organic molecules and biology. These experiments will help answer Astrobiology's fundamental questions on the origin, evolution, and distribution of life in the universe.

Spacecraft Overview

Continuing Ames' development of triple-cube nanosatellite technology and flight systems, which includes the successful GeneSat-1 and PharmaSat missions, O/OREOS is constructed from off-the-shelf commercial and NASA-designed parts to create a fully self-contained, automated, stable, light-weight space science laboratory with innovative environment- and power-control techniques; sensors to monitor the levels of pressure, temperature, humidity, radiation and acceleration; and a communications system able to regularly transmit data back to Earth for analysis. The satellite is equipped with a system to control the satellite's rate of rotation; a solar panel to generate power; a UHF "beacon" radio to help locate the satellite and communicate with the public; battery packs, and NASA's first propellant-less mechanism to ensure that once O/OREOS has completed its mission, it will de-orbit and burn up as it re-enters Earth's atmosphere.

Experiments Overview

The O/OREOS Space Environment Survivability of Live Organisms (SESLO) experiment will characterize the growth, activity, health and ability of microorganisms to adapt to the stresses of the space environment. Sensors within the SESLO payload will monitor the responses of biological organisms as they are exposed to radiation and weightless conditions in space for up to six months. The experiment is sealed in a vessel at one atmosphere and contains two types of microbes commonly found in salt ponds and soil in a dried and dormant state: *Halorubrum chaoviatoris* and *Bacillus subtilis*. After O/OREOS reaches orbit, the experiment will begin to rehydrate, or "feed," and grow three sets of the microbes at three different times: a few days, three months, and six months after launch. The SESLO experiment measures the microbes' population density and change in color while they consume the dyed liquid nutrients. This experiment helps scientists determine the effects of the combined exposure to space radiation and microgravity on organisms' growth, health and survival.

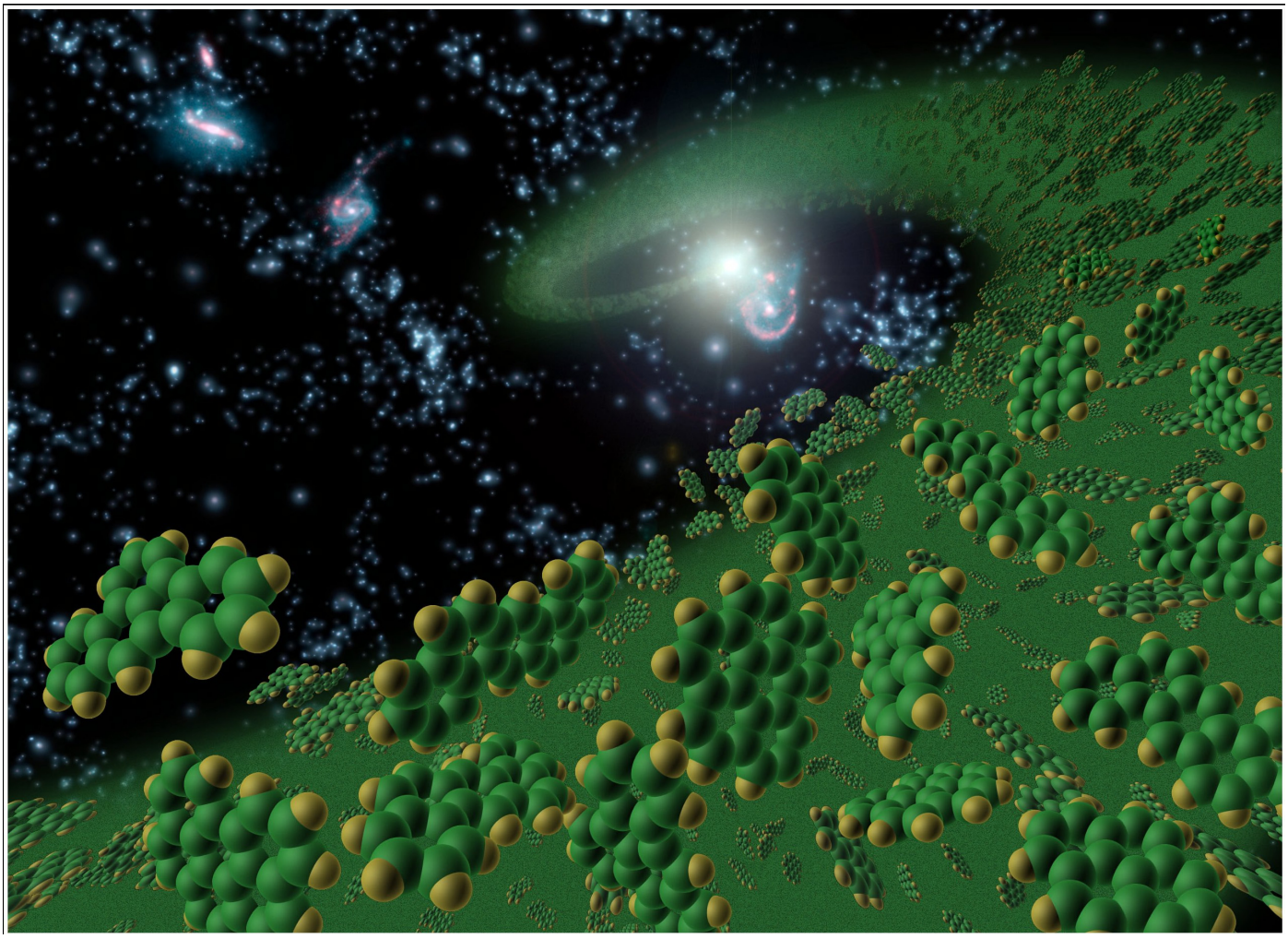
The O/OREOS Space Environment Viability of Organics (SEVO) experiment will monitor the stability and changes in four classes of organic molecules as they are exposed to space conditions. Scientists selected molecules known to be distributed throughout our galaxy as well as molecules that are the building blocks of life. The O/OREOS satellite will house organic samples in "micro-environments" to mimic space and planetary conditions. The experiment will continuously expose the organic matter to radiation in the form of solar ultraviolet (UV) light, visible light, trapped-particle and cosmic radiation over six months in space. Scientists will determine the stability of the organic matter by studying the changes in UV, visible and near-infrared light absorption.

Relevance to Astrobiology and Planetary Science Missions

NASA's Astrobiology Program studies the origin, evolution, distribution, and future of life in the universe. The O/OREOS mission will demonstrate new technological capabilities that can advance scientists' efforts in the field of Astrobiology research. Specifically, O/OREOS will demonstrate the ability of the low-cost nanosatellite platform to provide scientists with meaningful information about organisms and organic materials they expect to find in space.

The O/OREOS Team

The Small Spacecraft Division at Ames manages the O/OREOS payload for the NASA Science Mission Directorate at NASA's Headquarters in Washington. Santa Clara University, will support O/OREOS mission operations.
Pascale Ehrenfreund of the Space Policy Institute at George Washington University, Washington, is the O/OREOS project scientist; David Squires at Ames, is the O/OREOS project manager; John Hines at Ames, is the O/OREOS technical advisor; and Antonio Ricco at Ames, is the O/OREOS instrument scientist.



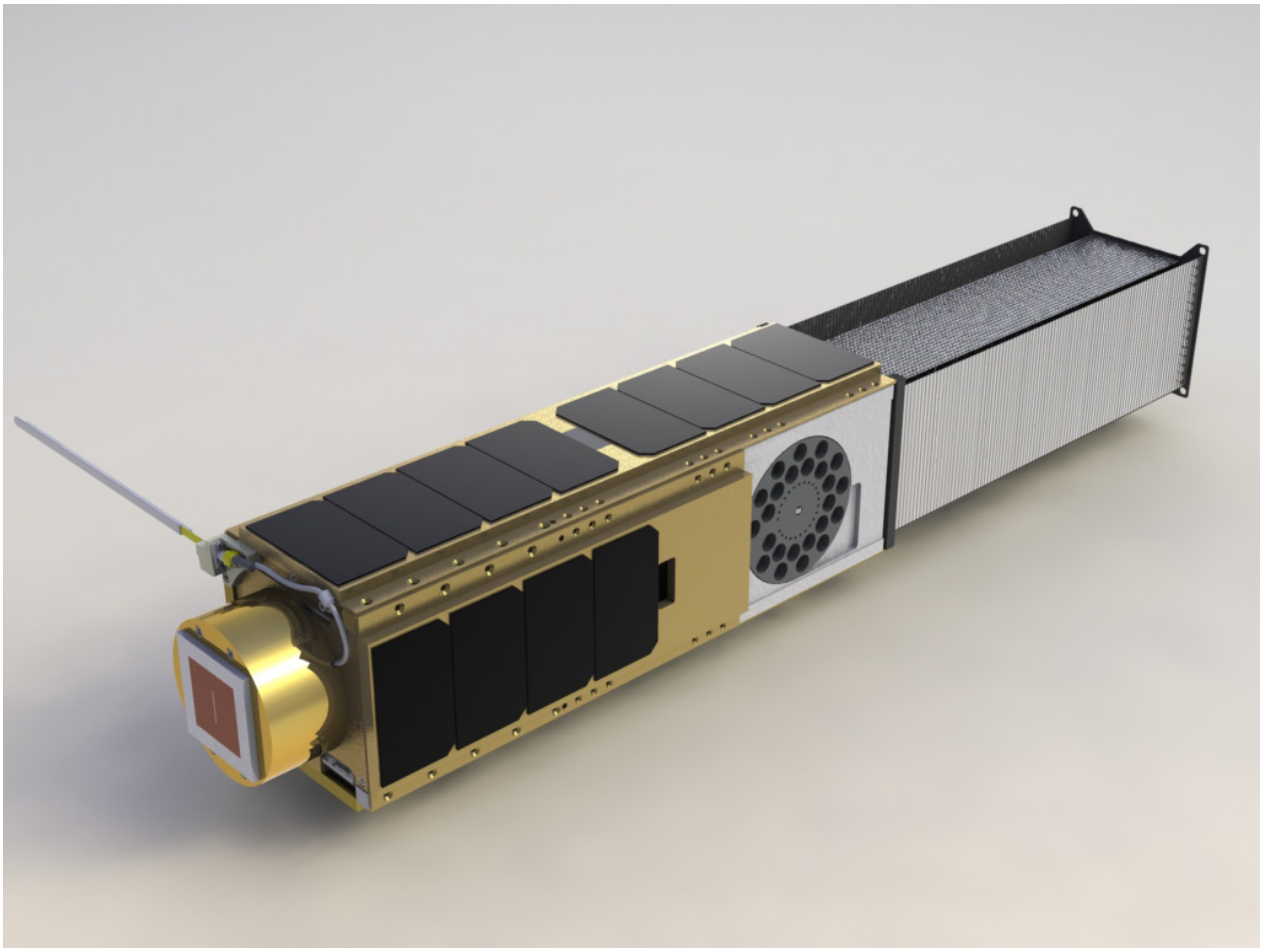
This artist's concept represents complex organic molecules, known as polycyclic aromatic hydrocarbons. These large molecules, comprised of carbon and hydrogen, are distributed throughout the Milky Way and other galaxies like it. They play a significant role in star and planet formation and are very common on Earth. They form any time carbon-based materials are not burned completely. They can be found in sooty exhaust from cars and airplanes, and in charcoal broiled hamburgers and burnt toast. Aromatic molecules identified in meteorites might have been beneficial to the origin of life on Earth. Image credit: NASA/JPL-Caltech

The O/OREOS science team includes Rocco Mancinelli of the Bay Area Environmental Research Institute, Sonoma, Calif., and Richard Quinn of the SETI Institute, Mountain View, Calif.; Andrew Mattioda and Orlando Santos at Ames; and Wayne Nicholson at the University of Florida, Gainesville, Fl., Support scientists include Nathan Bramall, Katie Bryson, Julie Chittenden and Amanda Cook at Ames.

For More Information

The O/OREOS mission Web site is located at:

www.nasa.gov/mission_pages/smallsats/oreos



A computer-generated image of the deployed O/OREOS nanosatellite. Image credit: NASA/Eric Stackpole

National Aeronautics and Space Administration

Ames Research Center
Moffett Field, CA 94035

www.nasa.gov

NASA Facts

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